DOCUMENT RESUME

ED 429 824 SE 062 386

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TITLE Connecting To Increase Task Variety in Biology Classroom--A Case Study.
PUB DATE 1999-03-00
NOTE 11p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (Boston, MA, March 28-31, 1999).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE EDRS Price MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Action Research; *Biology; Case Studies; *Classroom Communication; *Educational Technology; Foreign Countries; *Science Education; Scientific Literacy; Secondary Education; *Teaching Methods; World Wide Web
IDENTIFIERS Conceptual Change; Learning Cycle Teaching Method; Taiwan; Teacher Talk

ABSTRACT

This study explores the impact of a researcher-developed World Wide Web database on a variety of tasks and talk in a science classroom. The study was part of an experienced teacher's action research project designed to increase student engagement in biology class. Lessons were videotaped approximately once a week throughout the entire school year, written materials were collected, and the teacher was interviewed at regular intervals. The teacher employed a wide variety of task designs applying strategies such as concept mapping, group investigation, games and tournaments, and models such as the learning cycle and Driver's 5-stage conceptual teaching model. The teacher-student interactions that evolved from whole-class discussions were found to differ in the ownership of scientific talk. (Contains 10 references.) (Author/WRM)

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Connecting to Increase Task Variety in Biology Classroom —A Case Study

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Paper Presented at the 1999 Annual Meeting of the National Association for Research in Science Teaching Boston, MA, USA.

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ABSTRACT

This study is intended to explore the impacts of a researcher developed World Wide Web database on the task variety and science talks in a biology classroom. An experienced biology teacher who was conducting an action research to increase student's engagement participated in this study. The teacher connected to the database and planned lessons by applying the strategies provided. One of the teacher's classes was videotaped once a week in average in the whole school year. Written materials such as lesson plans and worksheets were collected and the teacher was interviewed regularly to clarify her rationale of each lesson plan. The interviews and whole-class discussions were transcribed and analyzed. It is found that the teacher used a wide variety of task designs applying concept mapping, Group Investigation, Team-Game-Tournament, Learning cycle, Driver's 5-stage conceptual change teaching model, and so on. Besides, the teacher-student interactions evolved in whole-class discussions were found differing in ownership of science talk.

OBJECTIVES OF THE STUDY

The National Science Council in Taiwan appraises the power of networks and encourages teacher education institutes incorporating learning networks into teacher education and professional development programs. Under the support of the NSC, the researcher developed a WWW database to serve junior high school biology teachers and to explore the ways in which the internet could benefit teacher professional development. The main components of this database are determined by a survey about teachers' needs. The impacts of using the database on teachers' teaching practice are to be determined. This study is aimed to examine the changes in task variety and the students' ownership of science talks in a biology classroom.

SIGNIFICANCE

Teachers whom conducting action researches to improve their science teaching are in need of supports from science educators in university. The researcher developed a database based on teachers needs. The primary purpose of the database established is to aid in the professional development of biology teachers by providing them a theoretical background, lesson plan examples, and online discussions to restructure their teaching practices. The findings from this study can provide the professional development program suggestions of modifications on the WWW database, and thus serving teachers with a powerful learning system to promote changing in junior high school biology teaching and learning.

THEORETICAL UNDERPINNINGS

There is a trend of innovative uses of technology in the education of future teachers and inservice teachers. The information technology is widely applied to enhance educational experiences in teaching and learning. Wagner (1993) reported variables affecting distance educational program success including needs assessment and other variables. Wagner claimed that to anticipate and support the needs of the users of services are critical to the success of distance educational enterprises.

Guo, Chiang and Chang (1997) and Guo, et al. (1998) reported a curriculum action research on a professional development program of inservice science and mathematics teachers in Taiwan. The inservice teachers had continuing demands of theoretical backgrounds, task design examples, and alternative assessment methods and other supports. However, the teachers are from all around the island, the turnaround time for collegial interactions makes a long-term face to face interaction unrealistic. Telecommunications can provide users educational opportunities to interact with science educators and reduce the time needed (Hunter, 1990; Schrum, 1991; Monahan & Dharm, 1995; Levin & Waugh, 1996).

Telecommunications technologies can fundamentally change the nature of learning and teaching (Levin & Waugh, 1996). Learning at a distance is different from conventional classroom learning (Wolcott, 1995). The growing world wide web that combining hypertext and multimedia is particularly good at transmitting audio- and video- information and stimulating users to explore further. Nevertheless, the important general features of successful WWW database use and the corresponding impacts on a reflective practitioner are need of systematic investigation.

PROCEDURE

THE SETTING

An experienced biology teacher planned to conduct an action research to increase students' engagement was invited to participate in this study. She got her master degree in Science Education right before involving in this study. During her work on master thesis, she observed four biology teachers who were trying out cooperative learning approach. The research experience impressed her and led her try to improve her own teaching practice.

The school site is located in a suburban city in northern Taiwan. The target class consisted of approximately 40 seventh graders of mixed sex and ability. The class had three 50-minute periods Biology per week.

The biology lessons most frequently included three phases. Lesson began with the teacher introducing the topic or reviewing with the entire class what they had previously investigated and discussed. This was followed by the teacher explaining

what the students would be investigating or discussing in the small groups. The second phase consisted of small-group discussion or investigation. The students worked in groups of four or five of mixed sex and ability to work on the tasks previously explained to them and recorded their consensus on worksheets. The final phase consisted of a whole-class discussion of the group results.

RESEARCHER-DEVELOPED DATABASE

The components of the database were determined by a survey of teachers' needs. The needs survey was developed by Baird and Rowsey (α =.96) to investigate perceived needs of science teachers in Alabama, USA (1989). The survey is a Likert type questionnaire and composed of fifty-four items categorized into seven subscales, those are improving personal competence as a science teacher (10 items), administering science instructional facilities and equipment (9 items), managing science instruction (7 items), delivering science instruction (13 items), planning science instruction (5 items), diagnosing and evaluating learners (6 items), and specifying objectives for science instruction (4 items). The survey was administered at the beginning of fall term and the end of spring term in school year 1996 in science teacher workshops. The survey was scored and tallied. Then, the components of database were decided based on the result of surveys and experts' suggestions. The database is developed and is consisted of teaching strategies, alternative assessment, classroom management tips, students' alternative conceptions, and online discussion. This researcher developed database is part of a web site (http://pckweb.ncue.edu.tw) purported to develop biology teachers' pedagogical content knowledge.

In the teaching strategy session, eight teaching strategies are provided, including Driver's five-stage conceptual change teaching approach, learning cycle, cooperative learning approach, Novak's concept mapping, questioning skills, general model of analogy teaching (GMAT), inquiry oriented teaching approach, and prediction-observation-explanation (P-O-E). In each teaching strategy, a description of the strategy as well as some lesson plans or worksheets developed by experienced biology teachers are provided. In the lesson plan modules session, an instruction of how to plan a lesson and how to use the modules provided are provided. In the classroom management tips session, the experiences shared by teachers are posted. In the students' alternative conceptions session, a brief description of students' alternative conceptions is introduced based on literature. Besides, WEB-bbs for users to share ideas and space for submitting electronic portfolio are also included.

The case teacher sent her worksheets regularly through e-mail to the researcher. The researcher with two other graduate students reviewed the plans and worksheets and give feedback to the case teacher through e-mail. After she taught each lesson, the videotape was viewed by the research team and modifications of the plan and

worksheet were made before posting it on the PCKWEB.

DATA SOURCES AND ANALYSIS

The target class was videotaped for the whole 1997 school year. The researcher visited the school site once per week in average and interviewed the teacher regularly to clarify her rationale of each lesson plan. The researcher gave advises after each visit on a request base. The artifacts collected included lesson plans and worksheets. The video tapes from the first three months were transcribed and analyzed by constant comparative method (Bogdan & Biklin, 1982). Besides, the researcher watched the tapes repeatedly and wrote down her interpretations of classroom events. Then, the researcher discussed with the teacher to negotiate the interpretations. All the data collected were analyzed by using constant comparative method (Bogdan & Biklin, 1982). After the researcher decided to focused on the talk pattern in whole class discussion sessions, the researcher videotaped the teaching and repeatedly watched the videotapes, kept journals, and transcribed all whole-class discussion segments. The segments were again analyzed by constant comparative method, and triangulated with field notes and transcriptions of teacher interviews.

MAJOR FINDINGS

From analyzing the worksheets, it is found that the teacher applied various teaching strategies provided in the database. That includes concept mapping, learning cycle, Group Investigation (GI), Team-Game-Tournament (TGT), and Driver's 5-stage conceptual change teaching model (worksheets will be shown in oral presentation). In addition to these, the teacher modified the open-ended discussion questions in the textbooks, and made tasks of matching terms, defining terms, explaining daily phenomena, and designing experiments.

The teacher's teaching competence in using students' works, adopting multiple teaching resources, asking open-ended questions were improving through the whole school year. The teacher stated that she learned to adopt students' works and students initiated activities as a substitute for pre-designed procedures to guide her teaching. Besides, the time allocating of each teaching phase was changed-- Time for group discussion and presentation/whole discussion were obviously increased while the reviewing and explanation phases were shorten.

The wide varieties of classroom activities motivated students and raised the on-task rate in the classroom. Analyzing the talks in whole-class discussions, it is found that the students helped in deciding what problems to be discussed and the teacher facilitated students' learning understandings instead of giving lectures. The decreasing frequency of QAE (teacher Question → student Answer → teacher Evaluation) pattern (Lemke, 1990) in whole-class discussion also suggested that the

teacher-student interactions in the classroom were transforming and different with what usually observed in a science classroom. Besides, it is found that the whole-class discussion was switching to a format of "students Present → teacher Negotiate understandings → students Apply concepts." The case teacher confessed that at the beginning of this study, she often designed tasks based on what she used to preach and just left the responsibility of instruction to the students. She frequently felt lost in helping students constructing concepts, especially when students reported conflicting answers. At the end of this study, she was progressed in terms of facilitating students' learning and teaching for understanding. However, she planned to improve her skills of negotiating understandings in next round of action research.

SUGGESTIONS

The teacher used to structure the whole lesson and guide the students accordingly. For the duration of this study, the students took parts in deciding what to discuss in the whole-class discussion phase. The teacher recognized it as a significant difference in her teaching. However, the teacher and researcher reached a consensus that in the whole class discussions, students reported conflicting ideas from time to time. The teacher confessed that she did not know how to make best uses of all these opportunities. Although sometimes she was successful in helping students restructuring ideas, she was uncomfortable with the feeling of being beyond her control. The teacher also reported that she struggled with how to deal with students' responses and help them learn related concepts.

For the duration of this study, the teacher was with a teaching load less than a teacher regularly had. She had plenty of time to think about how to apply the strategies provided and improve her teaching practice. It is obviously that the findings from this study are not necessary applicable to other situations. The teacher planned to try again in coming school year. It is expected that the allocation of time and the focus of discussion will be different, and that is worth further investigating before examining the effects of connecting to the database on a large scale.

The teacher also pointed out that a complimentary videotape that demonstrating teaching strategies suggested in the database should be provided. By this, the users can get a concrete idea about each teaching strategy and make appropriate modifications in advance. Even more, the teaching segment provided is expected to have functions of stimulating online discussions and promoting conceptual change of the users.

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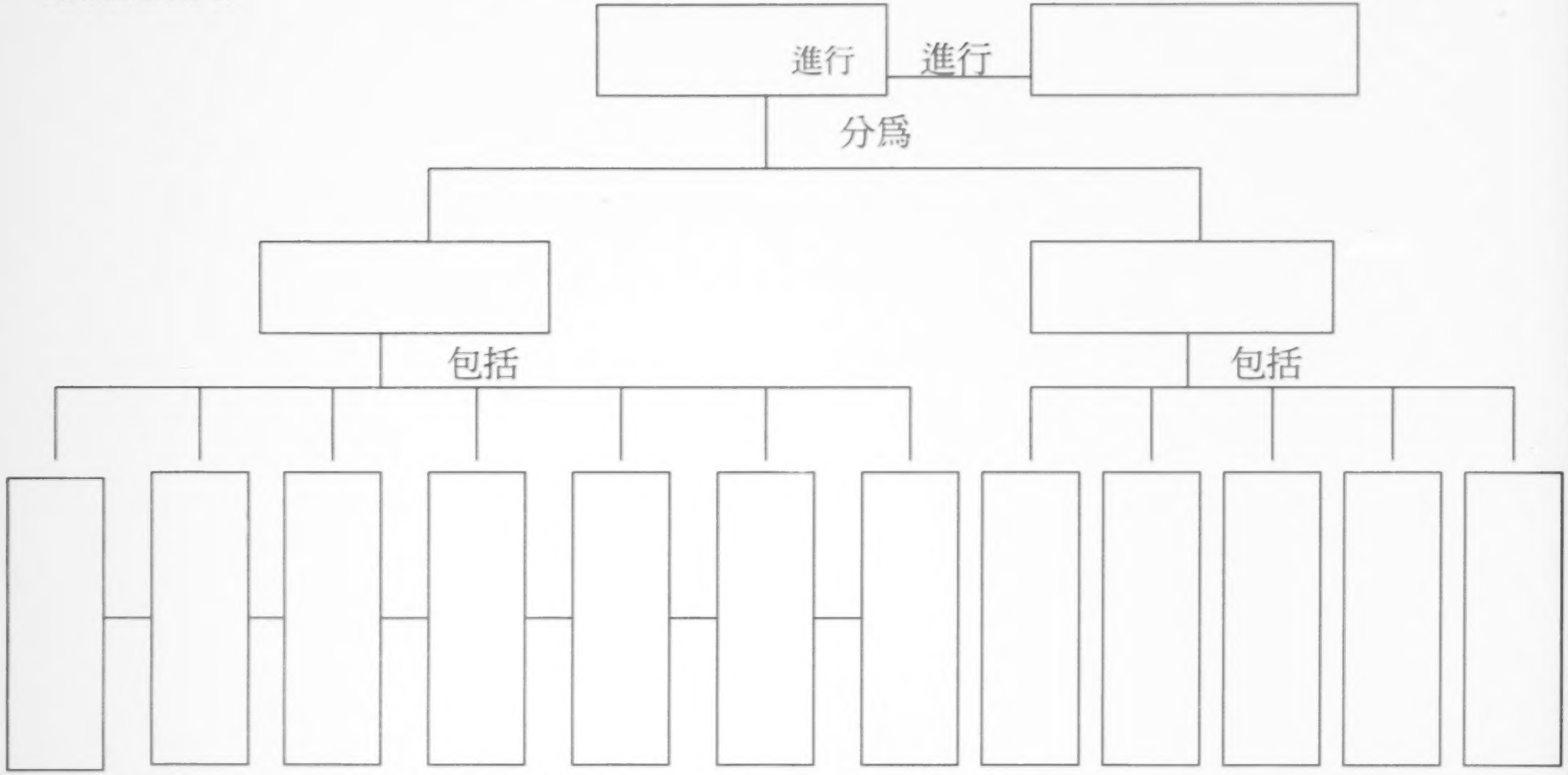
APPENDIX 1.



選項：消化管、消化腺、口腔、肝臟、唾腺、消化作用、小腸、肛門、咽頭、大腸、食道、胰臟、胃、消化系統、胃腺、腸腺。

APPENDIX 2.

國中生物科作業單　第四章（二）　一年　班第（　）組 姓名：　　座號：（　　）

人體循環系統之概念圖製作

1. 小組討論與記錄

請閱讀課文 4-3 ～ 4-5，找出關於***人體循環系統***重要的「***名詞***」，將我們這一組找到的名詞寫在下面的表格中。

2. 全班共同討論

請將其他組找到而本組先前遺漏的名詞記錄在下列表格中。

3. 小組活動

A. 將 1. 2. 項的名詞逐一寫在標籤紙上。

B. 把這些名詞依照「層次」的關係排列在卡紙上。

C. 有關係的兩個名詞之間用線連結起來。

D. 在連結線旁寫下一些敘述，說明它們之間的關係，例如「含有」、「包括」等等...

4. 個人記錄活動：

把本組完成的概念圖記錄在下面空白處。